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Textile wastewater treatment by phytoremediation efficiencies of water hyacinth (*Eichhornia crassipes*)

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ABSTRACT

Water hyacinth is proved to be effective in treatment of textile waste water. Generally textile waste water contains harmful heavy metals like iron and chromium. This study involves the removal of the harmful metals, Chemical Oxygen Demand (COD), Biochemical Oxygen demand (BOD), Total suspended Solids (TSS) and Total Dissolved Solids (TDS) by using phytoremediation. The objective of this study is determination of reduction of chromium and iron by using the water hyacinth (Eichhornia crassipes). Waste water treatment is done with the dilution of drinking water in the ratio of 35%, 40% and 45%. It shows significant reduction in all the pollutants with the passage of time. Thus water hyacinth can be an efficient biological agent in reducing the pollution loads in textile industry waste water.

KEY WORDS: Water hyacinth (*Eichhornia crassipes*), Textile water, Phytoremediation.

1. INTRODUCTION

Many industries such as textile, paper, plastic, leather tanning, uses dyes extensively in different operations. These dyestuff industries discharge variety of pollutants in different processes. Dyes exhibit considerable structural diversity and thus become difficult to treat them by a single process. It is a fact that due their visibility, dyes are recognized easily even at the levels as less as 1ppm. Toxicity of dyes to fauna and flora is well documented. Colour of textile effluents escalates environmental problem mainly because of its non-biodegradable characteristics. Today industries are the backbone of economy in many developed as well as developing countries. In India, it contributes to about 25% of total export earnings and providing employment to almost 'A of the total labor force. But, dye pollutants from various industries are important sources of environmental contaminations. Wastewater generated by the dye production industry and many other industries which use dyes and pigments is characteristically high in both color and organic content. Dyes are the serious polluters of our environment as far as color pollution are concerned. Dyes are synthetic aromatic organic compounds, which are normally used for coloration of various substances. During textile processing, inefficiencies in dyeing result in large amounts of the dyestuff (varying from 2% loss when using basic dyes to a 50% loss when certain reactive dyes used) being directly lost to the wastewater, which ultimately finds its way into the environment. Color is a visible pollutant and the presence of even very minute amount of coloring substance makes it undesirable due to its appearance. The effluents from dye manufacturing and consuming industries are highly contaminate the water resourses.

Colored coupled with high chemical and biochemical oxygen demands (COD and BOD) and suspended solids. Discharge of such effluents imparts color to receiving streams and affects its aesthetic value. The dyes are, generally, stable to light, oxidizing agents and heat, and their presence in wastewaters offers considerable resistance to their biodegradation, and thus upsetting aquatic life.

The application of aquatic plants to the removal of heavy metals from wastewater has gained increasing interest. Some freshwater macrophytes including Potamogeton lucens, Salvinia hergozi, Eichhornia crassipes, Cabomba sp., Cratophyllum demersum have been investigated for their potential in heavy-metal and color removal. Their mechanisms of metal and color removal by bio sorption can be classified as extracellular accumulation/precipitation, cell surface sorption/precipitation, and intracellular accumulation. These mechanisms can result from complexion, metal chelation, ion exchange, adsorption and micro precipitation. The removal of color from Dye bearing effluents is one of the major problems due to the difficulty in treating such wastewaters by conventional treatment methods. So present study was undertaken to evaluate the phytoremediation potential of water hyacinth (Eichhornia crassipes) plants against dye industry effluent and to Eichhornia crassipes as a remediation tool for dye-effluent pollution observe the effects of Dye wastewater on the growth of test plants.

Phytoremediation used for removing heavy metals and other pollutants by AMATS (aquatic macrophytes treatment systems) is a well-established environmental protective technique.

2. MATERIALS AND METHODS

2.1. Adsorbent Preparation: The inlet Textile effluents are collected from the textile industry located at Tirupur. The inlet effluents are taken in three fish tank respectively. The collected water is diluted in three various ratios. The first tank contained 35% of effluent sample. The second tank contained 40% of effluent sample. The third tank contained 45% of effluent sample. Water hyacinth is collected from local Sulur Lake, Covai. The roots of

collected water hyacinth plants are separated and extensively washed with tape water to eliminate soil dust and earthy materials. Finally roots were washed several times with distilled water and sliced manually for further use. The

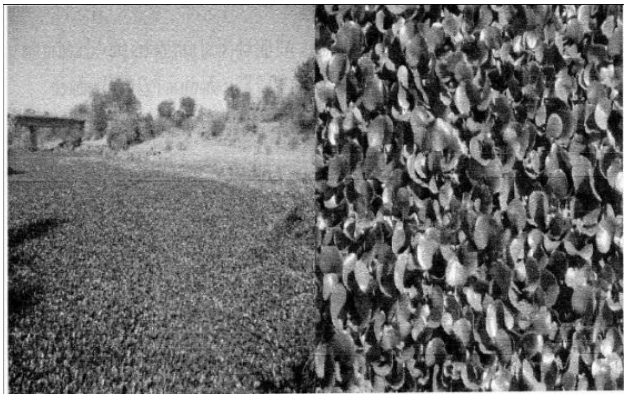
Fig 1 shows Water hyacinth plant used for treatment process. Water hyacinth is used due to its fast growth and large bio gas production capability. It has potential to clean up various waste waters. Inorganic contaminants such as nitrate, ammonium and heavy metals can be removed efficiently by water hyacinth through uptake and accumulation. Previously the roots of water hyacinth plants are used for phytoremediation of ethion and biosorption of reactive dyes.

2.2.Physico-chemical parameteranalysis:

Table.1.Physico-chemical parameters analyzed for collected sample Parameter

Parameters selected for this Study
p^H
Ammonia
Sulphate
Chemical oxygen demand(COD)
Electical Conductivity
Turbidity
Biochemical oxygen demand (BOD)
Chromium Iron
Total Dissolved Solids (TDS)
Total Suspended Solids (TSS)

Fig.1.Water hyacinth used for treatment process



2.3 Experimental Procedure for Treatment of Effluents with Aquatic Plants: Each of the tank was specified by an individual sample number (S-1- S -3), after that the sliced plants are immersed in different tank (containing inlet effluents) and mixed-up with the effluent well. The contents of various samples are as follows,

S-1: 350 m Linlet effluent + 50 mg of Water Hyacinth
S-2: 400 m Linlet effluent + 50 mg of Water Hyacinth
S-3: 450 m Linlet effluent + 50 mg of Water Hyacinth

3. RESULTS AND DISCUSSION

The tests are conducted for 5 days. All the physical parameters are reduced in the effluent samples. The figures 2 to 12 shows the variation of analysis. Fig.2 shows that the pH value is reduced from 9.2-7.9. The Fig.11 shows that the Chemical Oxygen Demand (COD) is reduced from 230-50. The Fig.10 shows that the Biological Oxygen Demand (BOD) is reduced from 550-400. The Fig.9 shows that the chromium content is reduced 0.477-0.07.

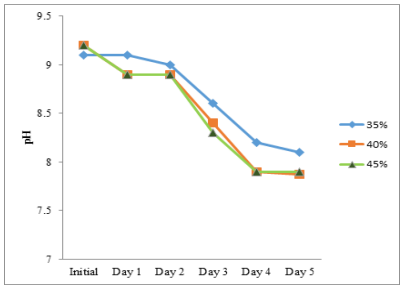


Fig. 2. Variation of p^H values

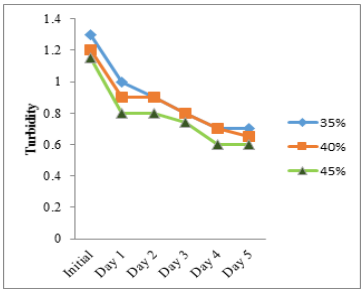


Fig. 3. Variation of Turbidity

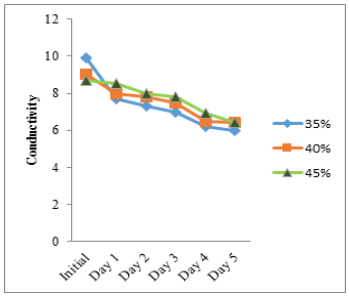


Fig. 4. Variation of Conductivity

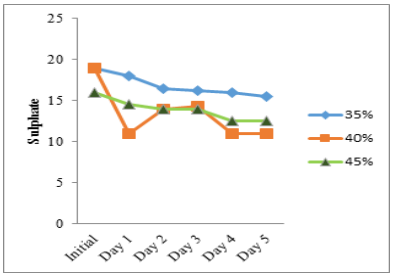


Fig. 5. Variation of Sulphate

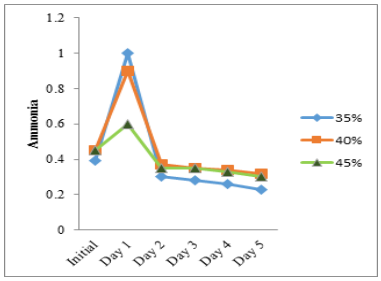


Fig.6.Variation of Ammonia

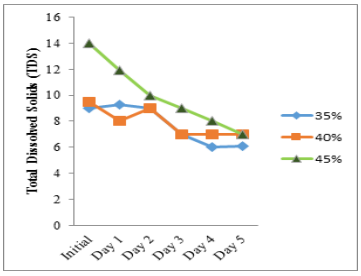


Figure.7.Variation of Total

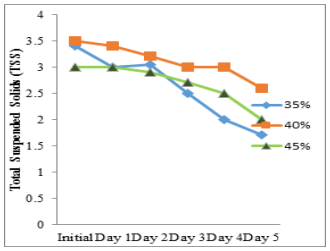


Figure.8.Variation of Total Suspended Solids

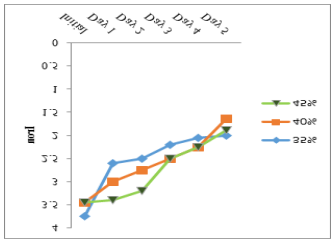


Figure.9.Variation of Iron Content

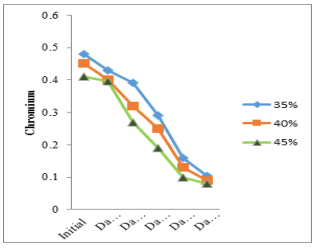


Figure.10.Variation of Chromium content

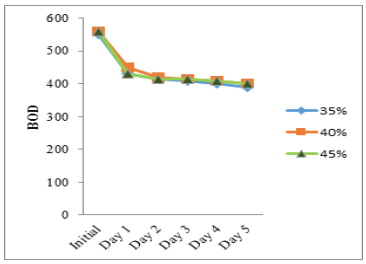


Figure.11.Variation of BOD

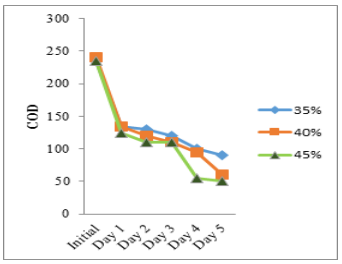


Figure.12.Variation of COD

4. CONCLUSION

There are various methodology employed for effluent treatment in textile industry. But, all the method is not significantly used in textile industry because of various difficulties such as time, cost, raw material unavailability etc. In this study, the investigation is carried out in the textile dye effluent by natural adsorbents namely water hyacinth and cactus opuntia. It is observed that these adsorbents are active in removal of dye and harmful pathogenic bacteria. From this study, the promising attributes of Water hyacinth includes its tolerance to dye and dye absorption along with good root development, low maintenance and ready availability in contaminated regions. These characteristics helps to prove that the suitability of water hyacinth in dyeing industry effluent treatment ponds. Hence, it is concluded that cactus opuntia and water hyacinth has the potential in removal of dye and harmful pathogenic bacteria and more useful for waste water treatment applications.

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